Rapid Emergency Restoration of Water Pipelines by Building a Leakage Information Gathering System
(Leakage Information Gathering by Utilizing SNS)

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INTRODUCTION (Background of Building the Leakage Information Gathering System)

The need for rapid restoration of earthquake pipeline damages

In the event of a magnitude 7 earthquake with Tokyo as its epicenter, it is expected that the water suspension rate will reach 30-40% due to water pipeline damages, which will cause tremendous damage to the functionality of the city and the lives of its residents.

In recent years, it has taken over 1 month to restore damaged pipelines after large earthquakes that have struck Japan, so there is need for rapid restoration of damaged pipelines. **(Figure 1)**

Figure 1 Waterworks damages in recent earthquakes

Earthquake Name	Earthquake Date	Magnitude (M)	Household with water cutoff	Longest cutoff
Hanshin Awaji	1995.1.17	7.3	1,300,000	3 months
Chuetsu, Niigata	2004.10.23	6.8	130,000	1 month
Great East Japan	2011.3.11	9	2,567,000	5 months
Kumamoto	2016.4.14	7.3	446,000	3 1/2 months

Ministry of Health, Labour and Welfare, ***Materials on Kumamoto Earthquake***

Measures to collect leakage information after an earthquake

In order to do rapid restoration of damaged pipelines, it is necessary to identify leakage locations and the scale of damages quickly.

Yet, in the event of an earthquake, some calls do not reach the Tokyo Waterworks call center, and many of those that cannot be answered because there are too many incoming calls to answer them all, so there is a high probability of obstructions to knowing the state of damages to pipelines. Furthermore, it is also expected that information collection and communication functions will be highly degraded due to information getting confused and the Tokyo Waterworks lacking personnel due to damage and disaster response.

However, in recent large earthquakes, which caused numerous water leakages, leakage information provided by residents on social media was used effectively for waterworks recovery efforts.

Therefore, the Tokyo Waterworks has decided to build a water leakage information collection system using leakage information from residents collected on social media (Twitter) as an earthquake countermeasure, so it is possible to identify leakage locations and damage scale quickly and contribute to the swift restoration of pipelines.

Advantages of collecting information from social media

(1) Can communicate even in the middle of an earthquake
(2) Information is immediate and substantial
(3) Collecting information is efficient

The leakage information collection system (Leakage information collection using social media)

The leakage information collection system using social media

1. Mechanism for collecting leakage information

In order to collect vast amounts of leakage information after an earthquake, the Tokyo Waterworks uses Twitter as an information collection tool which also has information sharing functions, sending out messages that ask users to provide leakage information. Tokyo Waterworks official account followers then provide leakage site information including pictures. (61,600 followers as of April 2018)

Method for collecting information on social media (Figure 2)

1) Send: The Tokyo Waterworks official account sends (tweets) requests to provide and diffuse information including detailed locations and on-site pictures of water leakage.
   Tweet texts give specific examples of how to write information.
2) Share: Tokyo Waterworks information provision requests reach many users by sharing (retweeting), leading to more information.
3) Site Check: Followers check leakage sites and take pictures.
4) Reply: Residents provide the Tokyo Waterworks with leakage information centralized and efficiently collected in the replies section in the form of replies to the Tokyo Waterworks tweets.

2. Mechanism for using leakage information

To efficiently collect, analyze, and use vast amounts of information for rapid pipeline restoration, bureau staff input leakage information collected on social media to the GIS data base. **(Figure 3)**

Information that has been input is aggregated there and accumulated on maps in the form of markers.

Report information registered to the same address can have up to 10 report markers stacked up. If there are 2 or more reports, the total will be shown as a number. **(Figure 4)**

This makes it possible for all staff to get a grasp of leakage locations and number of reports visually.

By aggregating information in this way, it is also possible to check whether multiple reported water leakages are actually at the same place. Staff can also save on-site pictures that have been sent to a shared folder on the Tokyo Waterworks server. (All staff can view this data) **(Figure 5)**

Figure 2 Requesting and collecting information with social media

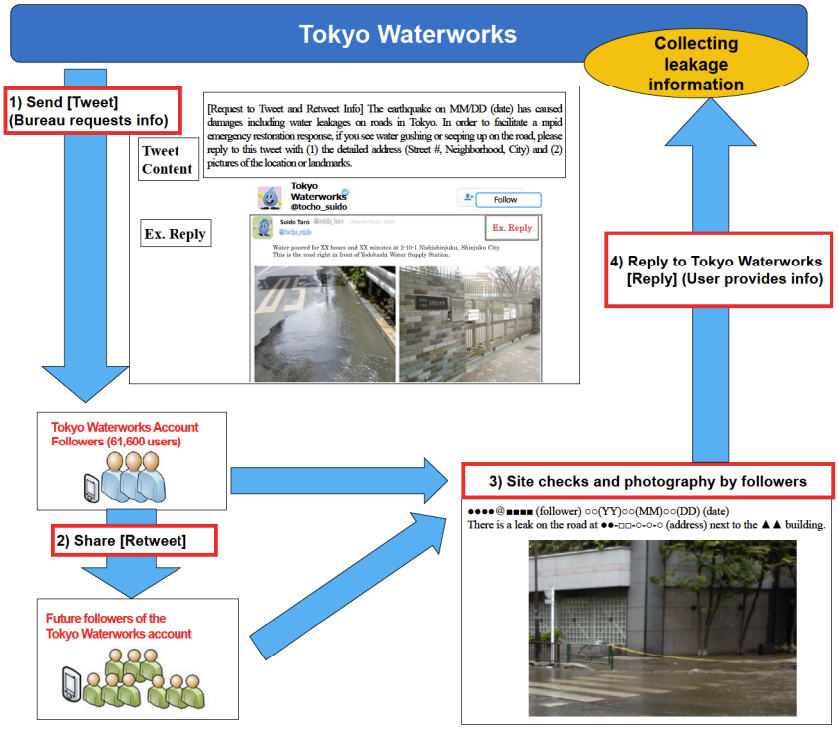
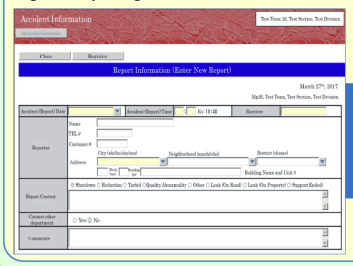


Figure 3 Inputting leak info to the GIS database



Reflected Automatically

Figure 4 Displaying leak info on GIS database

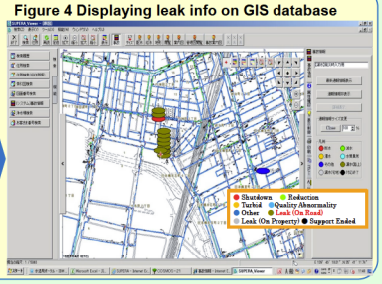
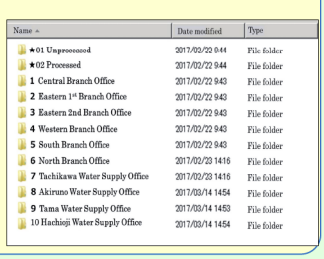


Figure 5 Registering on-site pictures

●●●●@■■■■ ○○(YY)○○(MM)○○(DD)
The road is flooded with water gushing out at ▲▲ intersection on ○○ Avenue in □□ District, ● City.

Register



Conclusion (Summary)

Social media is simple, used by many people, and can transmit on-site information with a sense of immediacy. Because of this, social media is an effective means of gathering and analyzing information on water leakage efficiently in the event of a disaster. This water leakage information collection system utilizing social media is already used in training. It is expected to attract a much larger number of reports than using telephones, and has made it possible to process information efficiently. (3 to 5 minutes saved for each report)

It is also expected to benefit pipeline restoration, as collecting many water leakage reports with photographs will enable departments in charge of emergency restoration to grasp the leakage situation rapidly and accurately, and apply this to pipeline restoration planning. In this manner, using social media will make it possible to develop more sophisticated disaster response mechanisms.

Reference 1 [Regarding damage estimation and countermeasure of Tokyo Inland Earthquake] (final report) Central Disaster Management Council, Cabinet Office, Japan. (December 2013)
2 [Damage assessment in Tokyo due to disasters including Tokyo Inland Earthquake] The Tokyo Metropolitan Government (April, 2012)
3 [Guidebook to utilize SNS in disaster response] Information and Communications Technology (IT) Comprehensive Strategy Office, Cabinet Secretariat, Japan. (March, 2017)
4 Shintaro Saito and others [Building a new mechanism to utilize information gathering by SNS (twitter) at the time of an earthquake to accelerating emergency restoration] By at Presentation Session on Water Works, National Conference of Japan Water Works Association. (2017)